CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A pixel cell comprising:

a photosensor having a first doped region and a second doped region in association with a semiconductor substrate;

an isolation region formed within said substrate; and

a halogen-rich region localized at least at a sidewall region of said isolation region.

2. The pixel cell of claim 1, wherein said halogen-rich region is between said isolation region and said photosensor.

3. The pixel cell of claim 1, wherein said halogen-rich region is formed with an ion selected from the group consisting of fluorine, chlorine, bromine, iodine, and any combination of fluorine, chlorine, bromine, and iodine.

4. The pixel cell of claim 1, wherein said halogen-rich region and said first doped region of said photosensor overlap.

5. The pixel cell of claim 1, wherein said halogen-rich region has a depth from a surface of said semiconductor substrate of about 300Å to about 800Å.

6. The pixel cell of claim 1, wherein said halogen-rich region has a concentration of halogen ions from about $5 \times 10^{13}/cm^3$ to about $5 \times 10^{15}/cm^3$.

7. The pixel cell of claim 1, further comprising a charge collection region electrically connected to readout circuitry.

8. The pixel cell of claim 7, further comprising a transfer transistor formed between and connecting said photosensor and said charge collection region.

9. An integrated circuit comprising:

an array of pixel cells, at least one pixel cell of said array comprising:

a semiconductor substrate having an isolation region formed therein;

a photosensor having a first doped region and a second doped region in association with said semiconductor substrate;

a halogen-rich region below said isolation region and between said photosensor and said isolation region; and

signal processing circuitry formed in said semiconductor substrate and electrically connected to said array for receiving and processing pixel signals representing an image acquired by said array and for providing output data representing said image.

10. The integrated circuit of claim 9, wherein said halogen-rich region is formed with an ion selected from the group consisting of fluorine, chlorine, bromine, iodine, and any combination of fluorine, chlorine, bromine, and iodine.

11. The integrated circuit of claim 9, wherein said halogen-rich region has a depth from a surface of said semiconductor substrate of about 300Å to about 800Å.

12. The integrated circuit of claim 9, wherein said halogen-rich region has a concentration of halogen from about $5 \times 10^{13}/cm^3$ to about $5 \times 10^{15}/cm^3$.

13. The integrated circuit of claim 9, wherein said at least one pixel cell further comprises a charge collection region formed in said semiconductor substrate.

14. The integrated circuit of claim 13, wherein said at least one pixel cell further comprises a transfer transistor formed between said charge collection region and said photosensor.

15. An image processing system comprising:

a processor;

an imaging device coupled to said processor, said imaging device comprising an imaging array containing a plurality of pixel cells, at least one pixel cell comprising:

a semiconductor substrate having a halogen-rich region,

an isolation region within said halogen-rich region, and

a photosensor having a first doped region and a second doped region in association with said semiconductor substrate; and

readout circuitry within said semiconductor substrate, said readout circuitry providing signals from said photosensor.

16. A pixel cell comprising:

a semiconductor substrate having trenches formed therein;

a halogen-rich region formed from about 300Å to about 800Å from a top surface of said semiconductor substrate;

a photosensor having a first doped region and a second doped region in association with said semiconductor substrate; and

an isolation region formed within said trenches of said semiconductor substrate.

17. The pixel cell of claim 16, wherein said halogen-rich region is formed with an ion selected from the group consisting of fluorine, chlorine, bromine, iodine, and any combination of fluorine, chlorine, bromine, and iodine.

18. The pixel cell of claim 16, further comprising a charge collection region in association with said halogen-rich region and electrically connected to readout circuitry.

19. The pixel cell of claim 18, further comprising a transfer transistor in association with said halogen-rich region, and between said photosensor and said charge collection region.

20. The pixel cell of claim 19, further comprising a reset transistor formed in association with said halogen-rich region and electrically connected to said charge collection region.

21. An integrated circuit comprising

an array of pixel cells, at least one pixel cell of said array comprising:

a semiconductor substrate having at least one trench formed therein;

a halogenated low constant dielectric material formed within said at least one trench; and

a photosensor having a first doped region and a second doped region in association with said semiconductor substrate; and

signal processing circuitry formed in said semiconductor substrate and electrically connected to said array for receiving and processing pixel signals representing an image acquired by said array and for providing output data representing said image.

22. The integrated circuit of claim 21, wherein said halogenated low constant dielectric material is formed with an ion selected from the group consisting of fluorine, chlorine, bromine, iodine, and any combination of fluorine, chlorine, bromine, and iodine.

23. The integrated circuit of claim 21, wherein said halogenated low constant dielectric material is formed of fluorinated silicon oxide.

24. The integrated circuit of claim 21, wherein said halogenated low constant dielectric material is planar to a topmost surface of said semiconductor substrate.

25. A method of forming a pixel cell, said method comprising the acts of:

forming a trench in a semiconductor substrate;

forming a halogen-rich region localized at least at a sidewall region of said trench;

filling said trench with a dielectric material; and

forming a photosensor having a first doped region and a second doped region in association with said semiconductor substrate.

26. The method of claim 25, wherein said act of forming a halogen-rich region comprises doping said substrate with an ion selected from the group consisting of fluorine, chlorine, bromine, iodine, and any combination of fluorine, chlorine, and iodine.

27. The method of claim 26, wherein said act of doping said substrate is performed by ion implantation.

28. The method of claim 26, wherein said act of doping said substrate is performed by incorporating halogen through a high density plasma deposition process.

29. The method of claim 26, wherein said act of doping said substrate is performed by solid source diffusion of halogen ions.

30. The method of claim 25, wherein said halogen-rich region is formed at a depth of about 300Å to about 800Å from a surface of said semiconductor substrate.

31. The method of claim 25, wherein said halogen-rich region is formed having a concentration of halogen from about $5 \times 10^{13}/cm^3$ to about $5 \times 10^{15}/cm^3$.

32. The method of claim 25, wherein said first doped region of said photosensor is formed to overlap with said halogen-rich region.

33. The method of claim 25, further comprising the act of providing a mask over said semiconductor substrate before said step of forming said halogen-rich region.

34. The method of claim 25, further comprising the act of forming a charge collection region in said semiconductor substrate.

35. The method of claim 34, further comprising the act of forming a transfer transistor between said photosensor and said charge collection region.

36. A method of forming an integrated circuit, said method comprising:

forming an array of pixel cells, at least one pixel cell of said array being formed by:

forming a semiconductor substrate having at least one trench formed therein;

forming a halogen-rich region at least at a bottom portion and a sidewall region of said at least one trench; and

forming a photosensor having a first doped region and a second doped region in association with said semiconductor substrate; and

forming signal processing circuitry in said semiconductor substrate and electrically connected to said array for receiving and processing pixel signals representing an image acquired by said array and for providing output data representing said image.

37. A method of forming an image processing system, said method comprising:

providing a processor;

forming an imaging device coupled to said processor, said imaging device comprising an imaging array containing a plurality of pixel cells, at least one pixel cell formed by:

forming a plurality of trenches in a semiconductor substrate,

forming a halogenated low constant dielectric material within each of said trench, and

forming a photosensor having a first doped region and second doped region in association with said semiconductor substrate; and

forming signal processing circuitry in said semiconductor substrate and electrically connected to said array for receiving and processing pixel signals representing an image acquired by said array and for providing output data representing said image.

38. The method of claim 37, wherein said halogenated dielectric layer is formed of fluorinated silicon oxide.

39. The method of claim 37, further comprising the step of planarizing said halogenated low constant dielectric material such that said halogenated low constant dielectric material is planar to a topmost surface of said semiconductor substrate.